APPENDIX C

Project Budget Analysis Section Detail

C1 The Project Budget

The most important cost estimate given during the course of a project's life is the first one – this is the number everyone remembers. Project Budgets are very difficult to establish during the predesign phase because the definitive design is not yet final. However, a realistic budget can be developed to reflect the following:

- **Project Scope –** The gross built area and volume, together with occupancy type and number of occupants in the building, set the stage for construction cost. This requires accurate identification of the agency or institution functional space requirements (see Appendix A).
- **Site –** The costs of developing the site and accommodating the building to it (see Appendix B).
- **Schedule –** It is necessary to establish an accurate project time line in concert with legislative funding schedules. The schedule may impact costs due to inflation factors and market conditions. Use standard escalation factors provided by the Office of Financial Management (OFM).
- **Quality and Performance Levels –** Building and systems quality levels must be established in order to achieve an adequate budget (see Appendix D).

The construction budget sets the stage for project design and is the framework within which all design decisions will be made. The predesign budget is an estimate based on the best information known at the time – it is not a guarantee.

C2 Cost Estimating Formats

To achieve consistency in evaluating agency or institution requests, a standardized format of cost reporting has been developed by OFM. Decisions effecting project costs are made throughout the budgeting, predesign, and design processes in an expanding fashion and using the following methods:

C2.1 Unit Costs

During the initial budgeting phase, construction budget estimates may be prepared using single-unit costs based on broad-accommodation parameters, for example: cost per student, cost per bed, cost per square foot of gross floor area or cubic foot of building volume. Any of these or similar measures may effectively generate an approximate project construction cost. Efficiency ratios and conversion factors for transforming net-to-gross floor areas, together with the cost per square foot of net usable area, may be useful in preparing estimates (see standards).

This information can then be tested in the predesign phase using costs per square foot of functional activities programmed for each space; for example, cost per square foot of wet laboratories versus that for offices and clerical spaces. Costs also vary based on basic criteria and design parameters of the building systems and components to be selected. Square foot building estimates are used at the budgeting phase only. As more information becomes available during predesign, schematic, design development, and construction document phases, cost estimates become more detailed.

C2.2 Uniformat

In the predesign phase, it is normal to use cost information based on the elements of each building subsystem to prepare the estimates. This method of system estimating is called the "Uniformat" system or Uniform Building Component Format. Figure C-1 illustrates the cost control and estimating system based on Uniformat down to Level 3. Level 2 cost estimating is required of all predesign document estimates. As the project moves forward into design, further detail based on the Uniformat structure should be used. For example, a Level 4 estimate should be prepared prior to bidding the project.

The Uniformat system allocates funds to the various functional areas of a facility and allows the designer to make early cost comparisons among alternatives. When life-cycle data is provided, a total cost analysis is possible.

Figure C-1

Uniformat Coding Structure

LEVEL 1	LEVEL 2	LEVEL 3	
A Substructure	A10 Foundations	A1010	Standard Foundations
		A1020	Special Foundations
		A1030	Slab on Grade
	A20 Basement Construction	A2010	Basement Excavation
		A2020	Basement Walls
B Shell	B10 Superstructure	B1010	Floor Construction
		B1020	Roof Construction
	B20 Exterior Closure	B2010	Exterior Walls
		B2020	Exterior Windows
		B2030	Exterior Doors
	B30 Roofing	B3010	Roof Coverings
		B3020	Roof Openings
C Interiors	C10 Interior Construction	C1010	Interior Partitions
		C1020	Interior Doors
		C1030	Interior Specialties
	C20 Stairways	C2010	Stair Construction
		C2020	Stair Finishes
	C30 Interior Finishes	C3010	Interior Wall Finishes
		C3020	Interior Floor Finishes
		C3030	Interior Ceiling Finishes

LEVEL 1	LEVEL 2	LEVEL 3	
D Services	D10 Conveying Systems	D1010	Vertical Transportation Systems.
		D1020	Other Transportation Systems
		D1030	Other Conveying Systems
	D20 Plumbing Systems	D2010	Plumbing Fixtures
		D2020	Domestic Water Distribution
		D2030	Sanitary Waste Systems
		D2040	Rain Water Drainage Systems
		D2050	Special Plumbing Systems
	D30 HVAC Systems	D3010	Fuel Supply Systems
		D3020	Heat Generation Systems
		D3030	Heat Rejection Systems
		D3040	Heat Distribution Systems
		D3050	Heat Transfer
		D3060	HVAC Controls and Instrumentation
		D3070	Special HVAC Systems and Equipment
		D3080	HVAC Systems Testing, Adjusting, and Balancing
	D40 Fire Protection Systems	D4010	Fire Protection Sprinkler Systems
		D4020	Standpipe and Hose Systems
		D4030	Fire Protection Specialties
		D4040	Special Fire Protection systems
	D50 Electrical Systems	D5010	Electrical Service and Distribution
		D5020	Lighting and Branch Wiring
		D5030	Communication and Security Systems
		D5040	Special Electrical Systems
		D5050	Electrical Controls and Instrumentation
		D5060	Electrical Testing
E Equipment & Furnishings	E10 Equipment	E1010	Commercial Equipment
		E1020	Institutional Equipment
		E1030	Vehicular Equipment
		E1040	Other Equipment
	E20 Furnishings	E2010	Fixed Furnishings
		E2020	Movable Furnishings
F Other Building Construction	F10 Special Construction	F1010	Special Structures
		F1020	Integrated Construction
		F1030	Special Construction Systems
		F1040	Special Facilities
		F1050	Special Controls and Instrumentation
	F20 Selective Demolition	F2010	Building Elements Demolition
		F2020	Hazardous Components Abatement

LEVEL 1	LEVEL 2	LEVEL 3	
G Building Sitework	G10 Site Preparation	G1010	Subsurface Investigation
		G1020	Site Clearing
		G1030	Site Demolition and Reallocations
		G1040	Site Earthwork
		G1050	Hazardous Waste Remediation
	G20 Site Improvements	G2010	Roadways
		G2020	Parking Lots
		G2030	Pedestrian Paving
		G2040	Site Development
		G2050	Landscaping
	G30 Site Plumbing Utilities	G3010	Site Water Supply & Distribution Systems
		G3020	Site Sanitary Sewer Systems
		G3030	Site Storm Sewer Systems
		G3040	Site Fuel Distribution Systems
		G3050	Site Special Plumbing Systems
	G40 Site HVAC Utilities	G4010	Site Steam Distribution Systems
		G4020	Site Hydronic Distribution Systems
	G50 Site Electrical Utilities	G5010	Site Electrical Distribution
		G5020	Site Lighting Systems
		G5030	Site Communication and Security Systems
		G5040	Other Site Electrical Utilities
	G60 Other Site Construction	G6010	Service Tunnels
		G6020	Other Site Systems and Equipment
Z General	Z10 General Requirements	Z1010	Administrative General Requirements
		Z1020	Procedural General Requirements
		Z1030	Temporary Facilities & Controls
	Z20 Bidding Requirements	Z2010	Bidding Requirements
		Z2020	Contract Forms
		Z2030	Conditions
	Z90 Project Cost Estimate	Z9010	Lump Sum
		Z9020	Unit Prices
		Z9030	Alternates/Alternatives

C2.3 Agency/Institution Project Request – Form C-100 and C-100A

For the Predesign Study, Forms C-100 for traditional design-bid-build projects and C-100A for alternative public works methods are used. These forms assist in developing and illustrating costs at different stages in project development. The use of these forms allows projects to be compared uniformly and consistently. The form also facilitates communications among all members of the project team, the agency or institution, OFM, and the Legislature, and allows study teams (value engineering, designers, consultants and reviewers) to quickly identify and focus on the various cost areas, and provide a basis for estimating life-cycle costs.

The information required on the forms is divided into eight standard categories to achieve consistency as follows:

1. Acquisition
2. Consultant Services
3. Construction Contracts
4. Equipment
5. Artwork
6. Other Costs
7. Contract Administration/Budget & Planning
8. Related Projects

Agencies/institutions should also include a written outline of all cost assumptions and an outline specification describing the building systems in summary form used in preparing the costs.

Appendix E contains copies of Forms C-100 and C-100A and brief instructions for completing the forms. Additional instructions and computer application disks are available from OFM.

C3 Life Cycle Cost Analysis and Cost Benefit Analysis

Life Cycle Costing (LCC) is the process of making an economic assessment of an item, area, system, or facility by considering significant costs of ownership over an economic life, expressed in terms of equivalent costs. The essence of LCC is the analysis of equivalent costs over the design life of each alternative discussed in the Predesign Study. To ensure that costs are compared on an equivalent basis, the baseline used for initial costs must be the same as that used for all other costs associated with each alternative under study, including maintenance and operating costs. LCC techniques should be used when undertaking a cost benefit analysis. The lack of such formal procedures can lead to poor decisions or choices.

C3.1 Terminology and Examples

- **Methods –** To compare design alternatives, both present and future costs for each alternative must be brought to a common point in time. One of two methods can be used. Costs may be converted to today's dollar value by the "present worth" method, or they may be converted to an annual series of payments by the "annualized method".

  The present worth method requires conversion of all present and future expenditures to a baseline of today's cost. Initial (present) costs are automatically expressed in present worth. The annualized method converts initial, recurring, and non-recurring cost to an annual series of payments. This method may be used to

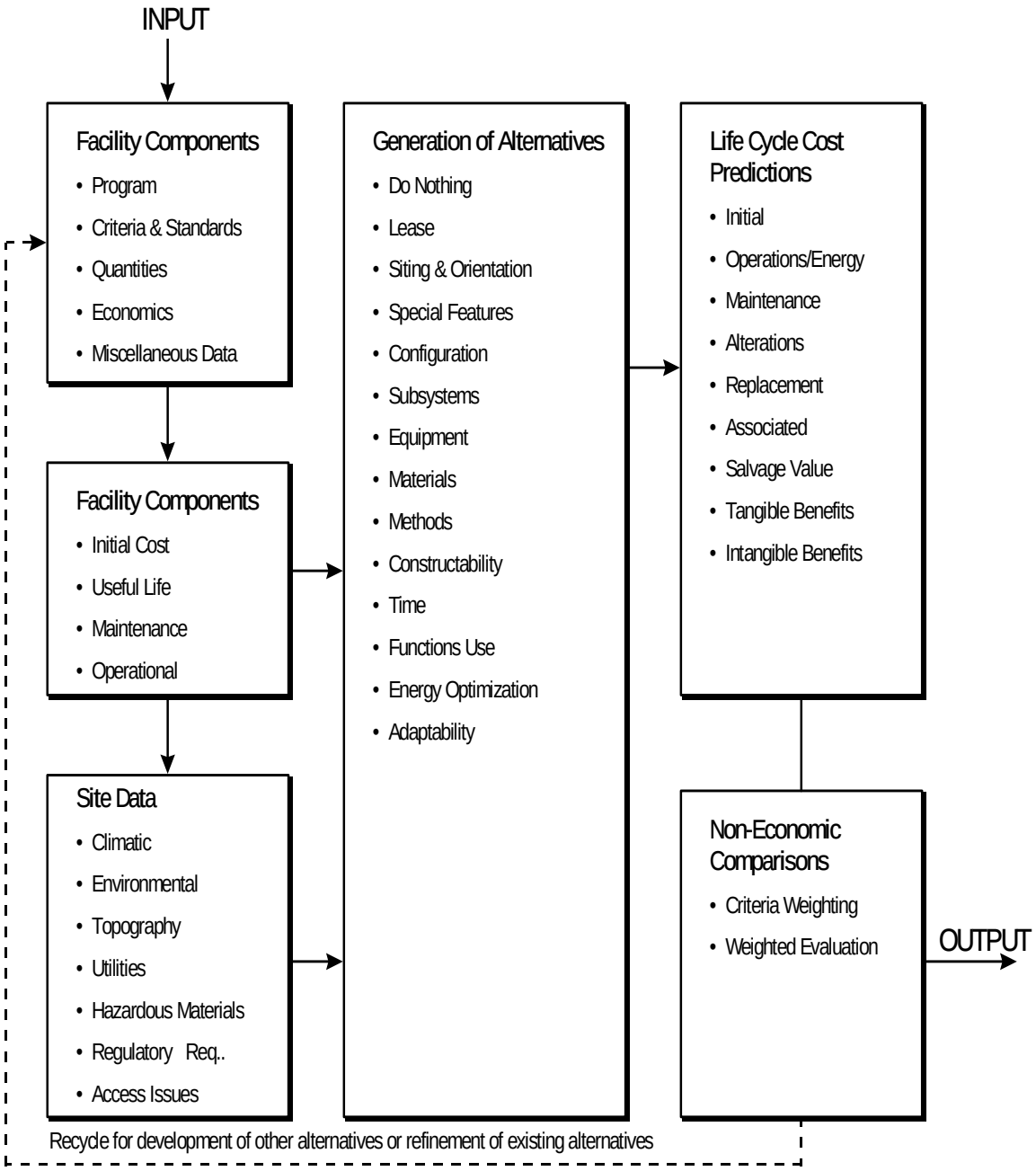
express all LCC as an annual expenditure.

Both the present worth method and the annualized method will result in the same economic recommendations. Because the present worth method allows easier consideration of differential escalation, it is the more common approach and is used and recommended for use during the Predesign phase.

- **Discount or Interest Rate –** Calculation of present worth is often referred to as discounting. Any reference to the discount rate means either the minimum acceptable rate of return for the owner for investment purposes or the current prime or borrowing rate of interest. Whatever rate is used in the calculations it must be clearly identified and consistent for each alternative studied.
- **Escalation –** Escalation has a significant impact on LCC and is accommodated in LCC by expressing all costs in terms of constant dollars. For example, if the LCC is being conducted in 1998 dollars, then the purchasing power of a 1998 dollar should be used throughout the analysis. When the comparative analysis includes items with equal escalation rates, the effect of escalation will be canceled out.
- **Salvage (Residual) Value –** When evaluating alternatives with unequal useful lives during the economic life cycle period, a salvage or residual value must be established. The salvage value is the estimated value (constant baseline currency) of the system or component at the end of the economic life cycle or study period. The value of a system at the end of its useful life is normally equal to its salvage value less the cost incurred for its removal or disposal.

C3.2 Life Cycle Cost Methodology

The following illustrates a flow chart for applying LCC to a project:



The first requirement is input data. With this data, alternatives can be generated, followed by LCC predictions. From these predictions, a non-economic comparison is made to evaluate the assumptions about component costs balanced with the functional, technological, and aesthetic factors of the project. The resultant weighted choice is proposed as the optimum alternative. This is the best alternative representing the best choice balancing costs and non-economic criteria. Of the input data required, specific project information and site data are usually

available (see Appendix A - Program and Appendix B - Site), but it is unusual for facility components data to be available, especially information regarding useful life, maintenance, and operations. Although such input is needed to calculate roughly 25 percent of total costs, few analysts have access to comprehensive data in a format facilitating LCC analysis. Currently, there is no system retrieval format for LCC data readily available. However, several published documents are available that provide this data.

C3.3 LCC Formats

The format for preparing LCC analysis is included in Appendix E – Forms. Although forms are available to be used to compare specific facility components such as the type of exterior siding, this manual only includes information for preparing an analysis of complete facility alternatives – the purpose of Predesign.